~~Claims~~

What is claimed is:

1. Process to produce redispersible nanocorundum with an average particle size $D_{50} < 100$ nm with the addition of nuclei that promote the transformation to corundum in the subsequent annealing, in which

   - as starting materials, chlorine-free inorganic precursors are dissolved in a liquid medium or processed to a sol,
   - this solution or the sol is hydrolyzed through the addition of a base in the mole ratio base : precursor = 1 to 3,
   - an aging takes place at temperatures between 60 and 98°C for 1 to 72 h,
   - a subsequent drying is followed by a calcination at temperatures between 350 and 650°C for the conversion of the hydrolyzed precursor into a semiamorphous intermediate phase and ultimately into transitional aluminum oxides,
   - and a further annealing is carried out for conversion into the corundum phase by means of a further temperature increase to $\leq$ 950°C.

2. Process to produce redispersible nanocorundum with an average particle size $D_{50} < 100$ nm with the addition of nuclei that promote the transformation to corundum in the subsequent annealing, in which

   - as starting materials, organic precursors in a liquid medium are processed into a solution or a sol,
   - after which the hydrolysis takes place either with excess water through the addition of the precursor solution or the precursor sol to water at a mole ratio water : precursor $>$ 3 and with the addition of an acid that leads to pH = 3-5, or through the addition of an amount of water restricted to a mole ratio water : precursor $\leq$ 3 to the precursor sol or precursor solution that in this case are to be mixed with complex-forming ligands,
   - an aging takes place at temperatures of $\leq$ 50°C within 5 h and subsequently an aging takes place at temperatures of 80 to 98°C within 1 to 24 h,
   - a subsequent drying is followed by a calcination at temperatures between 350 and

650°C for the conversion of the hydrolyzed precursor into a semiamorphous intermediate phase and then to transitional aluminum oxides,

- and the further annealing is carried out for the conversion to the corundum phase by means of further temperature increase to ≤950°C.

Process according to claim 1 or 2 in which the calcination is carried out at temperatures of 400 to 600°C for 0.5 to 2 h and the annealing for the formation of corundum is carried out by a temperature increase to 650 - 900°C for 0.5 to 1 h.

4. Process according to claim 1 or 2 in which the transitional aluminum oxides and/or corundum are ground.

5. Process according to claim 1 or 2 in which the grinding of the transitional aluminum oxides and/or corundum is carried out in an organic liquid.

6. Nanocorundum powders with a close particle size distribution in the low nanometer range, characterized in that they feature a narrow width of size distribution of isometrically formed particles $D_{84} < 150$ nm, less than 0.05% by weight chlorine in the composition, comprise at least 60% α-aluminum oxide, and are redispersible.

7. Use of nanocorundum powder according to claim 6 for the production of sintered corundum products in the form of dense or porous compact bodies, layers or granulates, whereby corundum granulate or sintered corundum form bodies with an average grain size of the structure of ≤ 0.6 μm dense sintered at temperatures ≤ 1450°C are used.

Process according to claim 1 or 2 with which after the aging of the solution or the sol, a gel formation or a liquid shaping is carried out, subsequently the drying, calcination and annealing take place and after the annealing a sintering is carried out at temperatures above the corundum formation temperature.

9. Process for coating porous or dense metallic substrates, in which the particles of the hydrolyzed sol, produced according to claim 1 or 2, or the particles of a suspension of nanocorundum, produced according to one of the claims 1 to 5 is deposited on the metallic substrates electrophoretically and subsequently subjected to an annealing.

10. Process for the production of sintered porous or dense corundum layers according to claim 1 or 2, in which after the aging the solution or the sol is applied to a substrate and afterwards the drying, calcination and annealing are carried out.

11. Process according to claim 10, in which after the aging of the solution or the sol, the material is deposited on a substrate, whereby the deposit of the layers takes place with gel formation.

12. Process according to one of the claims 10 or 11, in which after the annealing for corundum synthesis a sintering is carried out at temperatures above the corundum formation temperature.

13. Process according to one of the claims 10 to 12, in which after the annealing at least one further coating and at least one further annealing is carried out.

14. Al_2O_3 sintered products, produced according to at least one of the claims 8, 10, 11, 12 or 13, in which through annealing at 650 to 1250°C, there is a phase composition of more than 80% corundum and an average pore size of 10 - 100 nm with a porosity of ≥ 30% by volume.

15. Dense sinter corundum layers, produced according to one of the claims 1 to 5 and 8 to 13, on a materially different type of substrate, in which through sintering at a temperature of ≤ 1250°C there is an average grain size of the structure of ≤ 0.5 μm.

16. Process to produce nanoporous Al_2O_3 sintered products in which

- as starting materials chlorine-free inorganic precursors are dissolved in a liquid medium or processed to a sol,
- this solution or the sol is hydrolyzed by the addition of a base in mole ratio base : precursor = 1 to 3,
- an aging takes place at temperatures between 60 and 98° C for 1 to 72 h,
- a subsequent drying followed by a calcination at temperatures between 350 and 750°C is carried out for the conversion of the hydrolyzed precursors into aluminum oxide.

17. Process to produce nanoporous Al_2O_3 sintered products, in which

- as starting materials organic precursors are processed in a liquid medium to a solution or a sol,
- after which the hydrolysis takes place either with excess water through the addition of the precursor solution or the precursor sol to water at a mole ratio water : precursor >3 and with the addition of an acid leading to pH = 3-5 or through the addition of an amount of water limited to a mole ratio water : precursor ≤ 3 to the precursor sol or precursor solution in this case to be mixed with complex-forming ligands,
- an aging takes place at temperatures of ≤ 50°C within 5 h and subsequently an aging takes place at temperatures of 80 to 98°C within 1 to 24 hours.
- a subsequent drying is carried out followed by a calcination at temperatures between 350 and 750°C through conversion of the hydrolyzed precursors into aluminum oxide.

18. Process for the production of nanoporous layers according to claim 16 or 17, in which after aging the solution or the sol is applied to a substrate and afterwards the drying and calcination are carried out.

19. Process according to claim 18, in which after the aging of the solution or the sol, the material is deposited on a substrate, whereby the deposit of the layers takes place with gel

formation.

20. Process according to one of the claims 16 to 19, in which nuclei of a transitional aluminum oxide are added to the solution or to the sol.

21. Process for coating porous or dense metallic substrates, in which the particles of the hydrolyzed sol, produced according to claim 16 or 17, or the particles of a suspension of the nano porous aluminum oxide produced according to claim 16 or 17 is deposited on the metallic substrates electrophoretically.

22. Process for coating porous or dense metallic substrates according to claim 21, in which after the electrophoretical deposit of the particles, a heat treatment is carried out at temperatures of 350 --750°C.

23. Nanoporous Al_2O_3 sintered products, produced according to at least one of the claims 16 to 22, with which there is an average pore diameter in the range between 0.5 and 2.5 nm at a porosity of ≥30% by volume.

add B10

add C2

add C3 Abstract